



**NAVAL
POSTGRADUATE
SCHOOL**

MONTEREY, CALIFORNIA

THESIS

**CONTINUATION RATES FOR STAFF NONCOMMISSIONED
OFFICERS, IN A NON-OBLIGOR STATUS, SERVING
IN THE SELECTED MARINE CORPS RESERVE**

by

Reginald L. Hairston

March 2004

Thesis Advisor:
Second Reader:

Kathryn Kocher
Samuel Buttrey

Approved for public release, distribution is unlimited.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 2004	3. REPORT TYPE AND DATES COVERED Master's Thesis	
4. TITLE AND SUBTITLE: Continuation Rates for Staff Noncommissioned Officers, in a Non-obligor Status, Serving in the Selected Marine Corps Reserve.			5. FUNDING NUMBERS	
6. AUTHOR(S) Reginald L. Hairston				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943-5000			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (maximum 200 words) This thesis examines factors that influence the retention of male Staff Noncommissioned Officers (SNCOs) in the Selected Marine Corps Reserve who have completed their six-year initial military obligation. Data were extracted from the Reserve Components Common Personnel Data System. Logit regression was used to measure the influence of various demographic and military variables on retention to 15 years and retention to 18 years. Models were developed to assess the probability of a Marine SNCO staying to 15 years of service and 18 years of service, respectively. The thesis identified four significant factors that influence retention in the 15 year model, and five significant factors in the 18 year model. In both models, single Marines with no dependents are more likely to separate from the Selected Reserves than married Marines with dependents. Staff Sergeants (E6) are more likely to separate from the Selected Reserves than Gunnery Sergeants (E7), while Master Sergeants/First Sergeants and Master Gunnery Sergeants/Sergeants Major are more likely to reach the 15 and 18 year milestones than E7s. Serving in a combat support occupational field proved to be a significant predictor in the 18 year model, but it was not useful in the 15 year model.				
14. SUBJECT TERMS Retention			15. NUMBER OF PAGES 75	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

**CONTINUATION RATES FOR STAFF NONCOMMISSIONED OFFICERS, IN A
NON-OBLIGOR STATUS, SERVING IN THE SELECTED MARINE CORPS
RESERVE**

Reginald L. Hairston
Major, United States Marine Corps
B.S., James Madison University, 1988

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

**NAVAL POSTGRADUATE SCHOOL
March 2004**

Author: Reginald L. Hairston

Approved by: Kathryn Kocher, Advisor
Thesis Advisor

Samuel Buttrey
Second Reader

Douglas A. Brook, PhD.
Dean, Graduate School of Business and Public Policy

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

This thesis examines factors that influence the retention of male Staff Noncommissioned Officers (SNCOs) in the Selected Marine Corps Reserve who have completed their six-year initial military obligation. The data were extracted from the Reserve Components Common Personnel Data System. Logit regression was used to measure the influence of various demographic and military variables on retention to 15 years and retention to 18 years. Models were developed to assess the probability of a Marine SNCO staying to 15 years of service and 18 years of service, respectively. The thesis identified four significant factors that influence retention in the 15-year model, and five significant factors in the 18-year model. In both models, single Marines with no dependents are more likely to separate from the Selected Reserves than married Marines with dependents. Staff Sergeants (E6) are more likely to separate from the Selected Reserves than Gunnery Sergeants (E7), while Master Sergeants/First Sergeants and Master Gunnery Sergeants/Sergeants Major are more likely to reach the 15 and 18-year milestones than E7s. Serving in a combat support occupational field proved to be a significant predictor in the 18-year model, but it was not useful in the 15-year model.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	PURPOSE	1
B.	HISTORY/BACKGROUND	1
C.	MARINE FORCES RESERVE	2
1.	Ready Reserves	2
a.	Selected Marine Corps Reserve	2
b.	Individual Ready Reserve (IRR)	2
2.	Standby Reserve	2
3.	Retired Reserve	3
a.	Fleet Marine Corps Reserve (FMCR)	3
b.	Retired Reserve Awaiting Pay	3
c.	Retired Reserve in Receipt of Pay	3
D.	MILITARY SERVICE OBLIGATION	3
E.	SELECTED MARINE CORPS RESERVE FORCE STRUCTURE	4
F.	METHODOLOGY	7
G.	OVERVIEW OF THESIS	7
II.	LITERATURE REVIEW	9
A.	BACKGROUND	9
B.	TURNOVER THEORY	10
1.	Civilian Turnover Studies	11
2.	Military Studies	15
C.	SECONDARY LABOR MARKET	18
III.	DATA AND METHODOLOGY	21
A.	INTRODUCTION	21
B.	DATA	21
C.	DATA LIMITATIONS	22
D.	DESCRIPTION OF THE SAMPLE	23
1.	Retention	23
E.	EXPLANATORY VARIABLES	26
1.	Description	26
2.	Variable Construction	28
F.	METHODOLOGY	30
1.	Logistic Regression	30
2.	Retention Model Specification	30
3.	Hypothesized Effects of the Explanatory Variables	31
4.	Base Case	33
IV.	DATA ANALYSIS	35
A.	RESULTS - 15 YEAR MODEL	35
1.	Goodness of Fit	35

a.	<i>Global Null Hypotheses Test</i>	35
b.	<i>Hosmer-Lemeshow Test</i>	35
c.	<i>R-Square</i>	36
d.	<i>Classification Table</i>	37
2.	Interpretation and Evaluation of Coefficients	38
3.	Significant Variables and Partial Effects	39
a.	<i>Base Case or Reference Individual</i>	39
b.	<i>Partial Effects</i>	39
4.	Restricted Model Tests	40
5.	Potential Problems with the 15-Year Model	41
B.	RESULTS - 18 YEAR MODEL	43
1.	Goodness of Fit	43
a.	<i>Global Null Hypotheses Test</i>	43
b.	<i>Hosmer-Lemeshow Test</i>	43
c.	<i>R-Square</i>	44
d.	<i>Classification Table</i>	44
2.	Interpretation and Evaluation of Coefficients	45
3.	Significant Variables and Partial Effects	46
a.	<i>Base Case or Reference Individual</i>	46
b.	<i>Partial Effects</i>	46
4.	Restricted Model Tests	48
5.	Potential Problems with the 18-Year Model	49
6.	Multicollinearity	49
V.	CONCLUSIONS AND RECOMMENDATIONS	51
A.	CONCLUSIONS	51
1.	Significant Factors for Retention to 15 and 18 Years	51
2.	Factors That are Not Significant for Retention to 15 and 18 Years	53
B.	POLICY IMPLICATIONS	53
C.	RECOMMENDATIONS FOR FURTHER STUDY	55
	LIST OF REFERENCES	57
	INITIAL DISTRIBUTION LIST	61

LIST OF TABLES

Table 1.	Reserve Compostion of the Total Force	5
Table 2.	Reserve Component Selected Reserve End Strength Within 2% of the Fiscal Year Authorization	6
Table 3.	Correlates of Turnover	13
Table 4.	Frequency Distribution of Dependent Variables (N=931) for stay15 Logit Regression (% of total in parentheses)	23
Table 5.	Dependent Variable used in the Stay15 Continuation Model	24
Table 6.	Frequency Distribution of Dependent Variables (N=931) for stay18 Logit Regression (% of total in parentheses)	24
Table 7.	Dependent Variable used in the Stay18 Continuation Model	25
Table 8.	Explanatory Variable Frequencies for 15 and 18- Year Stayers	27
Table 9.	Continuation Model for Stay15 and Stay18	31
Table 10.	Stay15 and Stay18 Model Base Case	33
Table 11.	Hypothesized Effects of Independent Variables for Stay15 and Stay18 Models	34
Table 12.	Global Null Hypotheses Test for Stay15 Regression Model	35
Table 13.	Hosmer-Lemeshow Goodness of Fit Test for Stay15 Regression Model	36
Table 14.	R-Square and Max-rescaled R-Square for Stay15 Regression Model	36
Table 15.	Classification Table for the Stay15 Regression Model	37
Table 16.	Stay15 Regression Variable and Model Results for a One-tailed Test	38
Table 17.	Partial Effects of Explanatory Variables on Retention to Year 15	39
Table 18.	Stay15 Model Joint Significance Test for Family Status	41
Table 19.	Stay15 Model Joint Significance Test for Pay_Grade	41
Table 20.	Test for Multicollinearity in the 15 Year Model ...	42
Table 21.	Global Null Hypotheses Test for Stay18 Regression Model	43
Table 22.	Hosmer-Lemeshow Goodness of Fit Test for Stay18 Regression Model	44

Table 23. R-Square and Max-rescaled R-Square for Stay18 Regression Model	44
Table 24. Classification Table for the Stay18 Model	45
Table 25. Stay18 Logistic Parameter Estimates for One-tailed Test	45
Table 26. Partial Effects of Explanatory Variables on Retention to Year 18	47
Table 27. Stay18 Model Joint Significance Test for Family Status	48
Table 28. Stay18 Model Joint Significance Test for Pay_Grade	49
Table 29. Test for Multicollinearity in the 18 Year Model ...	50

ACKNOWLEDGMENTS

I would like to thank the following individuals who provided me with the support and guidance needed to successfully complete this thesis.

To Kathy Kocher, ma'am I will always cherish and remember your willingness and enthusiasm to assist me in this endeavor. Your work ethic inspired me to work that much harder and I feel that I have truly grown under your tutelage. Thank you.

To Sam Buttrey, sir your keen wit and eye for detail helped me refine my thoughts and ideas into written form. I appreciate your ability and love for teaching.

To my wife Tracey and my children: Lauren, Naomi, Miles, I cannot thank you enough for the love, support, and patience during the long hours I spent away from you preparing this thesis. You are and will always be my world.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. PURPOSE

This thesis examines the effects of various factors on the continuation rates of male staff noncommissioned officers (SNCO) in grades E6-E9 who have completed their legal obligation or contract and are now serving in a "nonobligor" status in the Selected Marine Corps Reserve (SMCR). Continuation is the decision of the SMCR member to continue drilling once he or she has completed his or her military service obligation. Logit regression models are utilized in order to examine the significance of military and demographic variables.

B. HISTORY/BACKGROUND

The Marine Corps Reserve is maintained for the purpose of providing trained units and qualified individuals for active duty in the Marine Corps in time of war or national emergency, and at such other times as national security may require. [Ref 1] Throughout the history of the United States, the military reserves have played a significant role in the country's ability to protect and defend its national interest. In order to maintain the country's military readiness status and manpower, a Total Force Concept was adopted in 1973. The Total Force Concept was developed as a means for ensuring that the nation retained the ability to activate a large force during times of total war or national emergencies. Since the Cold War, the National Guard and Reserve have become a larger percentage of the Total Force and are essential partners in a wide range of military operations, from smaller-scale

contingencies to major theater war. Today, reserve forces are included in all war plans, and no major military operation can be successful without them. [Ref 2]

C. MARINE FORCES RESERVE

The Marine Corps Reserve is broken down into three components: Ready Reserves, Standby Reserves, and Retired Reserves.

1. Ready Reserves

The Ready Reserve is made up of units and Marines of the Marine Corps Reserve subject to recall for active duty in the time of war or a national emergency, or when otherwise authorized by law. [Ref 3] The Ready Reserve is made up of the Selected Marine Corps Reserve (SMCR) and the Individual Ready Reserve (IRR).

a. Selected Marine Corps Reserve

The SMCR consists of three elements - SMCR units, Individual Mobilization Augmentees (IMA) and the Active Reserve. [Ref 1]

b. Individual Ready Reserve (IRR)

The IRR consists of all Marines in the Ready Reserve not affiliated with the SMCR who have not completed their Mandatory Service Obligation (MSO); or have completed their MSO and are in the Ready Reserve by voluntary agreement; or have not completed their MSO (are mandatory participants), but are transferred to the IRR. [Ref 1]

2. Standby Reserve

The Standby Reserve consists of Marines not in the Ready or Retired Reserve who are subject to recall to active duty in a time of war or national emergency. [Ref 4]

3. Retired Reserve

The Retired Reserve consists of the following Reserves:

a. Fleet Marine Corps Reserve (FMCR)

The Fleet Marine Corps Reserve is composed of enlisted personnel who have completed 20, but fewer than 30 years of active service and are receiving retainer pay. After 30 years of service, members of the FMCR are transferred to a retired list.

b. Retired Reserve Awaiting Pay

This category consists of eligible Reserve Marines who have completed at least the required 20 years of qualifying service, and have requested transfer to the Retired Reserve with pay. Retirement pay begins upon application by the member at age 60.

c. Retired Reserve in Receipt of Pay

This category consists of Reserve Marines with at least 20 years of qualifying service who at age 60 applied for and are receiving retirement pay. Members are placed on the Retired List of the Marine Corps Reserve. [Ref 1]

D. MILITARY SERVICE OBLIGATION

Anyone inducted, enlisted, or appointed into the Armed Forces on or after 1 June 1984 incurs an 8-year period of obligated service. Service-members who entered the service prior to 1 June 1984 incurred a 6-year obligation. Any part of the service obligation not served on active duty (AD) or active duty training (ADT) will be performed in a Reserve Component. [Ref 5] At the time of enlistment or

appointment, Marines incur a statutory obligation to serve in the military for eight years. Marines who continue to serve at the expiration of the statutory obligation serve in a "nonobligor" status. [Ref 6]

E. SELECTED MARINE CORPS RESERVE FORCE STRUCTURE

The SMCR consists of a combined arms force with balanced ground, aviation, and combat support units. Units are located in 47 states, Puerto Rico, and the District of Columbia. [Ref 1] In response to the Department of Defense's Total Force Policy, the Reserve Component was designed to have the same capabilities exhibited in the active force, and to provide the means for rapid augmentation and expansion of the Corps during a national emergency. The ability to seamlessly augment the active force is the dominant theme of Total Force planning, training, and administration. [Ref 1] Implemented in 1973, the Total Force Policy guides decisions about how the manpower resources available to the Department of Defense, active, reserve, retired military, federal civilian, contractor, and allied support personnel, are structured to protect the nation's interests. Maintaining the integrated capabilities of the Total Force remains essential for the U.S. defense strategy to succeed. [Ref 2] Table 1 depicts the contribution of the Marine Corps Reserve to the Marine Corps by indicating the percentage of reserve personnel in each type of reserve unit.

Table 1. Reserve Composition of the Total Force

From: <http://mcrsc.mfr.usmc.mil/GuideBook/04Sec1.pdf>

Unit	Percent Reservist
Civil Affairs Group	100
Air Naval Gunfire	100
Force Recon Unit	40
Communication Battalion	25
Tank Battalion	50
Artillery Battalion	33
Combat Engineer Battalion	33
Infantry Battalion	27
Light Armored Reconnaissance Air Defense Platoon	100
Adversary Squadron	100
Marine Light Attack Helicopter Squadron	21
Marine Fighter Attack Squadron	19
Marine Medium Helicopter Squadron	11
Marine Heavy Helicopter Squadron	9
Aerial Refueling	35
Marine Air Control Groups	25
Operational Support Airlift	25
Marine Wing Support Groups	25

Table 2 illustrates the Marine Corps Reserve Manpower Plan projected to Fiscal Year 2004 in relation to the reserve components of the other services. The SMCR or Selected Reserve numbers through FY 2002 remained within the authorized range. The fact that the Marine Corps consistently falls within the end strength range authorized by Congress is not surprising considering that it focuses on maintaining a junior force (Marines in pay grades E-1 - E-4).

Table 2. Reserve Component Selected Reserve End Strength Within 2% of the Fiscal Year Authorization

Reserve Component	FY 1999 Actual	FY2000 Actual	FY2001 Actual	FY2002 Actual/ Auth	FY 2003 Auth	FY2004 Projected
Army National Guard	357,469 (+0.1%) ¹	353,045 (+0.9%)	351,829 (+0.4%)	351,078/350,000 (+0.3%)	350,000	350,000
Army Reserve	206,836 (-0.6%)	206,892 (+0.9%)	205,628 (+0.2%)	206,682/205,000 (+0.8%)	205,000	205,000
Naval Reserve	89,172 (-0.2%)	86,933 (-3.7%)	87,913 (-1.1%)	87,958/87,000 (+1.1%)	87,800	85,900
Marine Corps Reserve	39,953 (-0.2%)	39,667 (+0.1%)	39,810 (+0.6%)	39,905/39,558 (+0.9%)	39,558	39,600
Air National Guard	105,715 (-1.2%)	106,365 (-0.3%)	108,485 (+0.4%)	112,075/108,400 (+3.4%)	106,600	107,000
Air Force Reserve	71,772 (-3.3%)	72,340 (-1.9%)	74,869 (+0.7%)	76,632/74,700 (+2.6%)	75,600	75,800
Coast Guard Reserve	8,110 (+1.4%)	7,965 (-0.4%)	7,976 (-0.3%)	7,816/8,000 (-2.3%)	9,000	10,000

Adapted from: 2003 Secretary of Defense Annual Report to the President and the Congress, p. 87.

¹ Percentages shown in the parentheses indicate how close the services came to meeting their authorized end strength. Example: In Fiscal Year 1999, the Marine Corps Reserve fell short of its authorized strength by .2 percent.

F. METHODOLOGY

The continuation behavior of "nonobligor" reservists is modeled by determining the probability that a reservist will continue in the SMCR after completing an Initial Military Obligation (IMO), given his or her individual characteristics. Logistic regression and cross-tabulation tables are used to analyze data extracted from the Reserve Component Common Personnel Data System (RCCPDS). The factors analyzed in this study are limited to personal characteristics and military-specific variables. The "nonobligors" identified are divided into two distinct groups, leavers and stayers. A stayer is defined as a Staff Noncommissioned Officer who continues to actively serve in the Selected Reserves for a minimum of nine years past an initial military obligation end date. The dataset is limited to Marines.

G. OVERVIEW OF THESIS

This thesis attempts to identify factors influencing retention of nonobligor male SNCO's (E6-E9). Personnel data obtained from the Reserve Components Common Personnel Data System (RCCPDS), which is maintained by the Defense Manpower Data Center, was used to build a multivariate model to assess the influence of various factors on retention.

Chapter II examines past empirical studies related to Reserve retention and attrition, and sets forth the basis for variable selection. Chapter III outlines the scope of the thesis, describes the data, specifies the model and defines the dependent and predictive variables. Chapter IV

provides a description and analysis of the SMCR retention model. Chapter V presents conclusions and recommendations drawn from the study.

II. LITERATURE REVIEW

This chapter focuses on two primary areas of research: Turnover Theory and the Secondary Labor Market Theory. The goal of this chapter is to develop a theoretical basis for a conceptual model that can be used to assess the impact of various factors on Reserve continuation rates.

Numerous retention and attrition studies have been conducted on the active force, and in recent years, there has been a growing interest in the reserve force; however, no study that focuses on the behavior of reservists who have fulfilled their military service obligation has been previously undertaken.

A. BACKGROUND

Retention is defined as a voluntary decision to remain in the military. There are a myriad of professional articles written about the subject of retention, and the vast majority of the literature focuses on the decision of a service-member to re-enlist at the end of his or her first term. The enlisted service-member who opts not to re-enlist at the end of his or her first term is still legally bound to a six or eight-year contract that was entered into in the original enlistment. If an enlisted service-member chooses not to reenlist, he or she is required to serve the remainder of his or her contract in the IRR. In the case of the "nonobligor", the statutory obligation of serving for a period of six or eight years has been satisfactorily fulfilled. Once the statutory

obligation is completed, any remaining service is solely at the discretion of the individual service-member. After completing his or her initial military service obligation, an enlisted Marine who continues to serve must enter into a new contract. The contract is a binding legal document that commits the enlisted member to a period of service, normally amounting to an additional four years. The distinction drawn here lies in the fact that the enlisted member who has completed his or her IMO makes a choice about whether or not to continue military service. A Marine who is still within the IMO window is bound by contract regardless of his or her personal desires.

The factors influencing the retention decision of individuals have been the subject of many studies. The research discussed below barely scratches the surface but serves to form the theoretical framework for the remainder of this paper.

B. TURNOVER THEORY

Turnover is the degree of individual movement across the membership boundary of a social system. [Ref 7] The following turnover studies can be divided into two categories: civilian research and military research. This section begins with an overview of key studies conducted in the civilian sector.

1. Civilian Turnover Studies

The study of job turnover has been the subject of numerous books, professional journals, and theses. The majority of early studies focused on the impact of a single variable on organizational turnover. [Ref 8] However, as researchers began to discover the role various other factors played in the turnover decision, models were expanded to include a multitude of variables. The following section highlights some of the major civilian turnover studies.

Herzberg, Mausner, Peterson, and Capwell (1957) conducted a comprehensive review of previous turnover studies that had examined the relationship between job attitudes of employees and turnover. They concluded that a worker's level of satisfaction or dissatisfaction is an important factor and that it varies with age group. [Ref 9]

March and Simon (1958) departed from the traditional organization theories that view the individual as a simple machine and explored the significance of motivation, conflict within an organization, cognitive limitations, and planning and innovation on an individual's decision to participate or not participate in an organization. [Ref 10]

Porter and Steers (1973) examined research related to turnover and absenteeism in work situations and developed four distinct categories of factors: organization-wide factors, immediate work environment factors, job-related factors, and personal factors. They determined that overall job satisfaction represents an important force in an individual's participation decision. In addition, they

discovered that employees with realistic expectations about what a job entails are less likely to quit than employees who have unrealistic expectations. [Ref 11]

Mobley (1977) investigated the relationship between job satisfaction and turnover. His article suggests that mediating steps exist between the time an employee becomes dissatisfied with his or her job and the actual act of quitting. [Ref 12]

Mobley et al. (1978) reported on the relationship between age, tenure, satisfaction, thinking of quitting, intention to search, probability of finding an acceptable alternative, intention to quit, and actual attrition. The research was designed to test the proposition that the influence of job satisfaction leads, indirectly, to the act of quitting. Age and tenure are included in this study but were not present in the 1977 model. [Ref 13]

Cotton and Tuttle (1986) conducted a meta-analysis of the turnover correlates examined in over 120 turnover studies with each study serving as one or more data points. Factors identified are divided into three broad categories: external factors, structural or work-related factors, and personal characteristics of the employees. [Ref 14] Table 3 outlines the turnover factors and their expected direction of relationship.

Table 3. Correlates of Turnover

CORRELATE	DIRECTION OF RELATIONSHIP
EXTERNAL CORRELATE	
Employment perceptions	Positive
Unemployment rate	Negative
Accession rate	Positive
Union presence	Negative
WORK RELATED	
Pay	Negative
Performance	Negative
Role Clarity	Negative
Task Repetitiveness	Positive
Overall Job Satisfaction	Negative
Satisfaction with pay	Negative
Satisfaction with Work Itself	Negative
Satisfaction with Supervisor	Negative
Satisfaction with Co-workers	Negative
Satisfaction with Promotion	Negative
Organizational Commitment	Negative

Correlates of Turnover cont.

CORRELATE	DIRECTION OF RELATIONSHIP
PERSONAL	
Age	Negative
Tenure	Negative
Gender	Positive (Women)
Biographical Information	None
Education	Positive
Marital Status	Positive (Married)
Number of Dependents	Negative
Aptitude and Ability	None
Intelligence	Positive
Behavioral Intentions	Positive
Met Expectations	Negative

Source: Cotton and Tuttle (1986), p. 61.

Ehrenberg and Smith (2000) note that personal characteristics influence worker migration or turnover, and that mobility is much higher among the young and better-educated. Ehrenberg and Smith also identify age as the

single most important factor in determining who migrates and find that education is the best indicator of who will move within a group. [Ref 15]

2. Military Studies

Military studies draw upon the extensive research and literature set forth in the civilian turnover literature. It is therefore not surprising to find that most of the key factors examined in civilian turnover research are also examined in military turnover studies.

May (1987) studied the attrition patterns of selected reservists and divided them into four personnel categories: non-prior service single, non-prior service married, prior service single, and prior service married. She pointed out that attrition from the Selected Reserve varies significantly among personnel categories. Personal characteristics appear to have a significant impact on attrition during the first three years of service; however, after three years of service, the survival rates among personnel categories become highly similar. [Ref 16] May concluded that following personal characteristics are important predictors for first-term attrition: age, marital status, education, gender, and race.

Fithian (1988) analyzed the retention decisions of male, first-term enlisted Selected Army Reservists. He concluded that the married variable is the only demographic variable that is consistently significant. [Ref 17]

Marsh (1989) developed a model for predicting retention in the U.S. Navy. The research extracted its

data from the 1985 DoD Survey of Officers and Enlisted Personnel Survey. Marsh found that military satisfaction has a significant effect on reenlistment intentions.[Ref 18]

Kocher and Thomas (1990) examined gender differences in retention among Army reservists using data from the 1984 Reserve Components Survey tracked through 1989 and concluded that important influences on retention varied between men and women within prior service and nonprior service groups. Reservists in the grades of E-4 to E-5 were used as the target population. Kocher and Thomas estimated separate models for prior service and nonprior service men and women. The variables used in the study included demographic variables, job characteristics, travel time to drill, pay grade, full-time civilian jobs, importance of retirement benefits, and composite factors measuring the income needs of the soldiers. [Ref 19]

Kirby and Grissmer (1993) define attrition as separation prior to completing an agreed-upon term of military service. Attrition is a traditional measure of all separations from a component. In the active force, early separations are generally individuals who leave for reasons that make them ineligible to return to the military. However, unlike the active force, many reservists who leave early are eligible to return as active participants and many do so and serve honorably for a long period. If an individual returns to serve in the Selected Reserves or the active force, he or she cannot be counted as a loss. Kirby and Grissmer note that service-members who transfer to the Individual Ready Reserve (IRR) are not

counted as active participants and are therefore regarded as losses to the total force. [Ref 20]

Zinner (1997) analyzed factors that influenced the retention of male, junior Marine Corps officers serving within their initial period of obligated service. He concluded that factors that significantly influence the officers' decision to remain on active duty are: commissioning source, occupational specialty, deployment to Operation Desert Shield/Storm, satisfaction with various intrinsic aspects of life in the Marine Corps, concerns with the force drawdown, whether or not the officer had searched for civilian employment in the last twelve months, and whether or not the officer believed that the skills he had acquired in the Marine Corps would be transferable to the civilian. [Ref 21]

Gjurich (1999) developed a model for predicting Surface Warfare Officer retention levels through the validation of a conceptual model. His research examined characteristics from personnel data in the Officer Master File and concluded that officers who stay in the service were most often designated as reservists or trainees, commissioned through the Reserve Officer Training Corps (ROTC) or Officer Candidate School (OCS), or had completed some level of graduate education. A classification tree model was utilized and it led to the conclusion that designation is the strongest predictor. [Ref 22]

Buttrey and Larson (1999) used a Classification and Regression Tree methodology to generate improved classification groups for predicting early-term behavior,

first-term attrition and re-enlistment patterns for Army first-termers. They discovered that the most important variables for predicting the aforementioned behavior are race and gender. According to their results, white women have the lowest term completion and re-enlistment rates; non-white women and white men have similar rates, and non-white men have the highest re-enlistment rate. [Ref 23]

O'Brien (2002) examined data from the Marine Corps Commissioned Officer Accession Career file and concluded that commissioning source was a key retention determinant. The variables studied by O'Brien include: The Basic School graduation rank, General Classification Test score, ethnicity, marital status, and Military Occupational Specialty. [Ref 24]

C. SECONDARY LABOR MARKET

Rostker and Shishko (1976) examined the reserve job from the viewpoint that it is a part-time job (moonlighting) used to supplement the income needs of the participating individual. The study evaluated the effects of economic variables on the decision of an Air Force Reservist to moonlight. [Ref 25]

Grissmer and Kirby (1985) discovered that Reservists are more strongly motivated by a propensity for the job than for the economic benefits derived from the job. [Ref 26]

Randall (1989) measured the impact of various demographic, economic, perceptual and satisfaction variables on retention. The analysis revealed different

patterns among four groups: prior service single, non-prior service single, prior service married, non-prior service married. [Ref 27]

Kirby et al. (1992) analyzed data from the 1992 Reserve Components Survey and discovered that 50 percent or more of reservists rank the following three factors well above the other factors: Retirement benefits, pride in accomplishment, and service to country. The proportion of enlisted personnel who cited retirement benefits as being important to his or her retention decision is higher than the proportion of officers who cite retirement benefits as being important to his or her decision to continue serving. [Ref 28]

In summary, the literature review briefly highlights some of the more prominent studies in the area of turnover and secondary labor market research. This thesis is based on the previous research examined above, but is limited to examining only those variables captured in the dataset provided by DMDC.

THIS PAGE INTENTIONALLY LEFT BLANK

III. DATA AND METHODOLOGY

A. INTRODUCTION

This chapter describes the data and the samples used in the statistical analyses, provides descriptions of the dependent and explanatory variables used in the models, and presents basic descriptive statistics. The purpose of the preliminary analysis is to identify potentially interesting information about the factors influencing retention through the use of cross-tabulation.

B. DATA

The Defense Manpower Data Center (DMDC) provided the data analyzed in this study. The files were extracted from the Reserve Common Component File maintained at Fort Ord, California.

RCCPDS is a computerized database maintained by DMDC-West. RCCPDS serves as a repository for all military reserve files. Each military department and the Coast Guard are required to prepare and submit a monthly "Master Officer File" and "Master Enlisted File" reflecting the status of each member of the reserve component as of the last day of each month. In addition, the military departments and the Coast Guard are also required to prepare an "Officer and/or Enlisted Transaction File(s)" reflecting the gains, losses, transfers, reenlistments, extensions, and changes of reserve component personnel. The transaction files are submitted on a weekly basis and include all daily submissions authorized as of the date of submission. [Ref 29]

In response to a request to have a file created that captured all actively drilling Marine Corps reservists (Selected Reservists), with an initial military obligation end date on or before 1 January 1990, three separate files were provided by DMDC: Marine Corps Reserve Losses (1990 - 1998), Marine Corps Reserve Losses (1999 - 2003), and a file that showed which reservists were still found in the RCCPDS active files through 2003. The sample included the following loss types: loss to civilian life, death, extended active duty, loss to another reserve component, and other loss: no longer in military but no specific transaction code to identify what happened.

The sample provided was further limited by eliminating all female observations because there were too few women Marines included in the data file to be useful for analysis. Observations below the pay grade of E-6 or above the pay grade of E-9 were also excluded. Pay grades E-6 through E-9 capture the ranks of Staff Noncommissioned Officers, the focus of the study.

C. DATA LIMITATIONS

The primary limitation presented by the data was the number of observations that were missing valid information. In several cases the lack of valid data made it impossible to use variables in the analysis that were often referred to in the literature as correlates of retention. The fact that the research was already limited to using only those variables present in the DMDC-provided data sets only served to magnify the impact of losing a variable due to poor data collection/extraction. Geographic region and prior active military service are prime examples of two

variables that could have potentially enhanced the explanatory power of the models presented in Chapter IV, but had to be excluded due to lack of data. The latter two data sets provided by DMDC were superior to the 1990 - 1998 data set because the number of cases with missing data had been greatly reduced. However, the data matching process required heavy reliance on the first file in order to track observations from January 1990 through their loss transaction or the year 2003, whichever occurred first.

D. DESCRIPTION OF THE SAMPLE

1. Retention

a. Retention depends on a Marine's choice of remaining in the Selected Reserves (reenlisting or extending) or separating from the Selected Reserves. Therefore, a model that attempts to predict whether or not a reservist will continue serving in the Selected Reserves has to have a dichotomous dependent variable. For the purposes of this thesis, the dependent variable was coded as a 1, in the 15 Year Model, if a reservist served to year 15 and coded as a 0 if the member separated prior to year 15. Table 4 shows the results of the initial frequency report generated for the 15-year dependent variable.

Table 4. Frequency Distribution of Dependent Variables (N=931) for stay15 Logit Regression (% of total in parentheses)

Stay15 Continuation Model	Number (%)
Retained until 15 th year	828 (88.94)
Not retained for 15 years	103 (11.06)

Source: RCCPDS

b. The dependent variable "Stay15" for the 15 year model was created by subtracting the obligated military service separation date, (MSO_Expire), from the separation transaction date or the current date if the reservist is still drilling.² Table 5 shows how the dichotomous dependent variables for identifying stayers and leavers in the 15 Year Model were created.

Table 5. Dependent Variable used in the Stay15 Continuation Model

Variable Description	Variable Name	Variable Type	Range
Retention to 15 years	Stay15	Binary	= 1 if transaction date is 0 or transaction date >= MSOExpire + 9. is 0 otherwise

Source: Author, derived from RCCPDS

c. In the 18 Year Model, the dependent variable was coded as a 1 if a reservist served to year 18 and was coded as a 0 if the member separated prior to year 18. Table 6 shows the results of the initial frequency report generated for the 18-year dependent variable.

Table 6. Frequency Distribution of Dependent Variables (N=931) for stay18 Logit Regression (% of total in parentheses)

Stay18 Continuation Model	Number (%)
Retained until 18 th year	747 (80.24)
Not retained for 18 years	184 (19.76)

Source: RCCPDS

² The Initial Military Obligation occurred at year six for the Marines in this study.

d. The dependent variable "Stay18" for the 18 year model was created by subtracting the obligated military service separation date, (MSO_Expire), from the separation transaction date or the current date if the reservist is still drilling.³ Table 7 shows how the dichotomous dependent variables for identifying stayers and leavers in the 18 Year Model were created.

Table 7. Dependent Variable used in the Stay18 Continuation Model

Variable Description	Variable Name	Variable Type	Range
Retention to 18 years	Stay18	Binary	= 1 if transaction date is 0 or transaction date \geq MSOExpire + 12 = 0 otherwise

Source: Author, derived from RCCPDS

e. Years 15 and 18 were chosen as the retention milestones for this study. Year 15 was chosen as a milestone date because it clearly identifies this study's target sample group. Marines who are still actively drilling at the 15-year mark will, in all likelihood, have advanced, at a minimum, to the pay grade of E-6 and nonobligors in pay grades E6 and above are the focus of this research. The 15-year milestone also marks a point at which a Marine has completed 75 percent of the needed service to qualify for retirement eligibility. By Year 15, the average enlisted Marine will have reenlisted three

³ The IMO occurred at year six for the Marines in this study.

times. For this specific study, Year 15 was also the first candidate milestone year in the sample that yielded enough leavers for a meaningful analysis. Year 18 was chosen as the second milestone instead of year 20 because it allowed for evaluation of the entire dataset. Year 20 would have been a better choice since one of the focuses of this research was to determine what portion of Marines actually make it to retirement, once they have moved pass their IMO; however, this was not practical since a large percentage of the observations were not tracked for an entire 20 years. In the data sets provided, every observation had the potential to stay to Year 18.

E. EXPLANATORY VARIABLES

1. Description

a. The explanatory variables chosen for this study are: marital status, family status, number of dependents, race/ethnicity, education, pay grade and military occupation. The frequency report shown in Table 8 reveals that more than 75% of the sample Marines are married and over 65% are married with dependents. The frequency report also reveals that only 14% of the Marines are classified as members of a minority race/ethnic group and that only 16.86% of the Marines captured in the sample have a Bachelor's or Master's Degree. The distribution by pay grade is fairly evenly spread among E6s and E7s, 32.33% and 32.12% respectively, but starts to decline sharply for pay grades E8 and E9. The combat support occupational field accounts for 65.02 percent of the observations

present in the data set. Table 8 lists the explanatory variables chosen for the Stay15 and Stay18 models and displays their resulting frequency distributions and the percent of Marines who stay to year 15 or 18.

Table 8. Explanatory Variable Frequencies for 15 and 18-Year Stayers

Explanatory
Variable

Personal

	Freq.	Pct.	Pct. Stay to 15	Pct. Stay to 18
<u>Marital Status</u>				
Single	207	22.2	84.1	76.8
Married	724	77.8	90.3	81.2
<u>Family Status*</u>				
Married w/deps	607	65.2	90.0	81.2
Married no deps	117	13.0	92.3	81.2
Single w/deps	107	12.0	87.0	82.2
Single no deps	100	11.0	81.0	71.0
<u>Number Dependents*</u>				
zero dependents	324	35.0	87.0	78.4
one dependent	155	17.0	88.0	79.0
two dependents	232	25.0	88.0	82.0
three dependents	154	17.0	95.0	82.0
four or more	66	7.1	98.0	87.3
<u>Race/Ethnicity</u>				
White	803	86.3	89.0	80.0
Minority	128	14.0	91.0	83.0
<u>Education</u>				
Bach_MastersDeg	157	17.0	89.0	83.4
Other	774	83.1	89.0	80.0

**EXPLANTORY VARIABLE FREQUENCIES FOR 15 AND 18 YEAR STAYERS
CONT.**

	Freq.	Pct.	Pct. Stay to 15*	Pct. Stay to 18*
Military				
<u>Pay Grade</u>				
SSgt	301	32.3	81.0	63.0
Gunnery Sergeant	299	32.1	89.0	81.3
E8	218	23.4	96.0	95.0
E9	113	12.1	97.4	97.4
<u>Military Occupation</u>				
Cbtarms	318	35.0	90.0	82.0
Combatspt	591	65.0	88.2	79.0

N = 931 (Totals may not add up to 931 due to missing data)

* The spouse was subtracted from the dependent total.

Source: Author, from data provided by DMDC.

2. Variable Construction

a. The candidate demographic variables were selected based on the literature review and within the constraints of the RCCPDS data sets. Candidate demographic variables include: marital status, family status, race/ethnic group and education variables.

(1) Marital status: In the original source codebook, the variable "Marital Status" is divided into nine separate categories. The low frequency for many categories made it practical to consolidate the nine categories into two categories: married and single.

(2) Family status is a hybrid variable created by combing marital status and number of dependents. In order to ensure that the number of dependents count

doesn't include the spouse, one dependent was subtracted from the total number of dependents for married Marines with one or more dependents.

(3) Race/Ethnic Group: This variable is divided into twenty-one subgroups in the RCCPDS. Other than white, no other category had enough members to serve as a comparison group. In order to create a group with enough representation to be meaningful, the ethnic groups, not including white, were combined to create a separate variable called "minority".

(4) Education: This variable is divided into 28 subgroups in the RCCPDS. Marines with a Bachelor's or Master's Degree were combined to create a separate variable, "Bachelor_MastersDeg", and any Marine who did not have a Bachelor's or a Master's Degree was coded as a zero.

b. The candidate military variables were selected based on the literature review and within the constraints of the RCCPDS data sets. Candidate military variables include:

(1) Pay Grade: The pay grades of E6 (SSgt), E7 (Gunnery Sergeant), E8 (Master/First Sergeant), and E9 (Master Gunnery Sergeant/Sergeant Major) represent the ranks that fall into the category of Staff Noncommissioned Officers. All pay grades below E6 were eliminated from the data in order to create an accurate picture of differences in continuation among the four SNCO ranks.

(2) Primary Military Occupational Specialty: In RCCDPS each Marine is assigned a numeric military occupational specialty. For the purposes of this research, and based on examples found in the literature

review, the military occupational specialties were combined to form two separate groups: "combat arms" and "combat support".

F. METHODOLOGY

1. Logistic Regression

a. In this study, the value of the dependent variable is interpreted as the probability of a Marine continuing to serve as a drilling member of the SMCR up to a pre-selected milestone year of service.

$$P(\text{continue to drill}) = 1 / (1 + e^{-(B_0 + B_1 X_1 + \dots + B_K X_K)})$$

P is the probability that a Marine continues to serve in the SMCR and e is the base of the natural logarithm. The X_i s are the values of the explanatory variables, the B_i s are the values for the estimated parameters of the model, and K denotes the number of explanatory variables measured for each individual.

The logistic regression procedure was chosen because it is best suited for binary dependent variables. Logistic regression eliminates the unboundedness problem found in the linear probability model by using a variant of the cumulative logistic distribution.

2. Retention Model Specification

The theoretical continuation model specification shown in Table 9 is based on variables suggested by the literature review.

Table 9. Continuation Model for Stay15 and Stay18

Logit Retention Model for Remaining for a Minimum of 15 years:

stay15=f(Family_Status, Race/Ethnic Group, Military Occupational Field, Education, Pay_Grade)

Logit Retention Model for Remaining for a Minimum of 18 years:

stay18=f(Family_Status, Race/Ethnic Group, Military Occupational Field, Education, Pay_Grade)

Source: Author.

3. Hypothesized Effects of the Explanatory Variables

a. The independent variables for the stay15 and stay18 continuation models were chosen based on previous studies and the author's experience. The variables that are hypothesized to increase continuation propensity among Staff Noncommissioned Officers are: Education less than a Bachelor's or Master's Degree, pay grade of E8 or E9, combat support, single with dependents, and minority. Variables hypothesized to have a negative effect are: combat arms, single no dependents, married no dependents, pay grade of E6, and a college degree.

(1) Family status is described by four binary categories: married with dependents (base case), married no dependents, single with dependents, and single no dependents. It is hypothesized that, compared to the base case, each of the family status categories will have a negative relationship with the probability of continuation because their perceived freedom to leave isn't as strongly influenced by a concern for stability as it would be for a

Marine reservist with a spouse and dependents. A one-tailed test is be used to analyze the results.

(2) The Race/Ethnic variable, minority, is hypothesized to have a positive influence on the dependent variable in comparison with white (base case). Traditionally higher unemployment rates for minorities are the reason this variable is expected to be positive. A one-tailed test is used to analyze the results.

(3) The Education variable compares Marines who have earned a Bachelor's or Master's Degree with those Marines who have not. The Marines who have not obtained Bachelor's or a Master's Degree serve as the base case. It is hypothesized that earning a higher degree will make a member less likely to continue serving because of their increased marketability in the civilian sector. A one-tailed test is used to analyze the results.

(4) Pay grade has been recoded to produce four separate binary ranks: SSgt, Gunny, E8 and E9. The base case is the rank of Gunny (E7). The coefficient for SSgt's (E6) is expected to have a negative sign in comparison with the base case because it is expected that a Marine will be less likely to voluntarily continue serving if he has failed to advance in rank. The ranks of E8 and E9 are hypothesized to have positive signs in comparison with the base case because it is expected that the higher pay and prestige of advancing in rank are significant in the decision to continue serving in the Selected Reserves. A one-tailed test is used to analyze the results.

(5) Military Occupational Field was consolidated into two distinct categories, combat arms (base case) and combat support. Marines serving in combat support jobs are hypothesized to be more likely to stay in comparison with the base case because the jobs performed are less demanding for an older population of Marines and therefore more enticing. A one-tailed test is used to analyze the results.

4. Base Case

The base case to which each of the independent variables are compared is a white, married Gunnery Sergeant (E7) with dependents, who has less than a college education, and serves in a combat arms specialty. Table 10 summarizes the base case variables.

Table 10. Stay15 and Stay18 Model Base Case

Independent Variable	Base Case Variable
Ethnicity	White
Marital Status	Married with dependents
Occupational Field	Combat Arms
Education	< Bachelor's or Master's Degree
Pay Grade	E7

Source: Author.

Table 11. summarizes the hypotheses about the relationship of the independent variable and actual continuation behavior.

Table 11. Hypothesized Effects of Independent Variables for Stay15 and Stay18 Models

Variable Name	Expected Sign
Demographic Category	
Marital Status	
Married no dependents	-(compared to married with dependents)
Single with dependents	-(compared to married with dependents)
Single no dependents	-(compared to married with dependents)
Ethnicity Group	
Minority	+(compared to white)
Education	
College Degree (Bachelors or Masters)	-(compared to lower educational level)
Service Information Category	
Military Occupational Field	
Combat Support	+(compared to combat arms)
Pay Grade	
Staff Sergeant	-(compared to Gunnery Sergeant)
E8	+(compared to a Gunnery Sergeant)
E9	+(compared to a Gunnery Sergeant)

Source: Author.

IV. DATA ANALYSIS

A. RESULTS - 15 YEAR MODEL

1. Goodness of Fit

a. Global Null Hypotheses Test

The global null hypotheses test indicates that the 15 year model shown in Table 12 is significantly better, at the .01 level, than a model with just the intercept.

Table 12. Global Null Hypotheses Test for Stay15 Regression Model

Model Fit Statistics			
	Criterion	Intercept Only	Intercept and Covariates
	-2 Log L	638.325	590.214
Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	48.1105	9	<.0001

Source: Author.

b. Hosmer-Lemeshow Test

The Hosmer-Lemeshow Goodness of Fit Test is a formal test for whether the predicated probabilities for the covariates match the observed probabilities. A large p-value means that there is a good match. The results of

the Hosmer-Lemeshow Test for the Stay15 model shown in Table 13 indicate a good fit.

Table 13. Hosmer-Lemeshow Goodness of Fit Test for Stay15 Regression Model

Chi-Square	DF	Pr > ChiSq
5.2801	8	.7273

Source: Author.

c. R-Square

Generalized (or pseudo or Cox and Snell) R-square is based on the likelihood ratio chi-square for testing the global null hypothesis that all the coefficients are equal to zero. A problem with the generalized R-square is that its largest possible value is less than one. The Max rescaled (or Nagelkerke) R-square adjusts for this. The values of .0516 and .1022 produced as pseudo R-Squared and Max R-squared values, respectively, indicate this model with a limited set of predictor variables, not unexpectedly, has limited predictive ability. Table 14 shows the R-square and Max-rescaled R-square values generated for the Stay15 model.

Table 14. R-Square and Max-rescaled R-Square for Stay15 Regression Model

R-Square	Max-rescaled R-Square
0.0516	0.1022

Source: Author.

d. Classification Table

To obtain a predicted response for each observation, a decision rule must be applied to the predicted probabilities. This rule establishes a cut-off above which an observation is classified as a predicted event. In choosing to set the classification cut-off field to a value other than the default of 0.5, the prevalence of the event being predicted in the sample is often used as the cut-off value. Here that cut-off would be the proportion of the sample of nonobligors who are stayers. The actual proportion who stayed to 15 years is .8878. Table 15 shows classification table results at the .50 and .89 probability cut-off levels. The classification output indicates that at the .89 probability level, the model correctly predicts 59.7 percent of the observations correctly. It is not surprising that this model, which is limited to a small number of demographic and military background predictors, has limited success in prediction.

Table 15. Classification Table for the Stay15 Regression Model

Classification Table									
	Correct		Incorrect			Percentages			
Prob Level	Event	Non- Event	Event	Non- Event	Correct	Sensi- tivity	Speci- ficity	False Pos	False Neg
.500	807	0	102	0	88.8	100.0	0.0	11.2	.
.890	471	72	30	336	59.7	58.4	70.6	6.0	82.4

2. Interpretation and Evaluation of Coefficients

Table 16. depicts the results of the Stay15 regression. The explanatory variable "single no dependents" is significant at the .05 level while "SSgt", "E8" and E9" are statistically significant at the .01 level for a one-tailed test. Each of the statistically significant variables has the hypothesized sign shown in Table 11.

Table 16. Stay15 Regression Variable and Model Results for a One-tailed Test

Parameter	Estimate	Std. Error	Chisq	Pr >Chisq ^a
Intercept	2.0079	0.2628	58.3689	<.0001
marriednodeps	0.3187	0.3991	0.6376	0.4246
Singlenodeps**	-0.5667	0.3020	3.5210	0.0606
Singledeps	-0.2675	0.3252	0.6765	0.4108
Minority	0.0542	0.3475	0.0243	0.8761
Bachelor_MastersDeg	-0.0256	0.2896	0.0078	0.9295
Combatspt	0.1747	0.2377	0.5404	0.4623
SSgt***	-0.6285	0.2386	6.9371	0.0084
E8***	1.1001	0.3929	7.8374	0.0051
E9***	1.5192	0.6182	6.0394	0.0140
Model Fit Statistics				
Criterion	Intercept Only		Intercept and Covariates	
-2 Log L	638.325		590.214	
Likelihood Ratio				
Chi-Square	DF		Pr>ChiSq	
48.1105	9		<.0001	

*** Statistically Significant at the .01 level.

** Statistically Significant at the .05 level.

* Statistically Significant at the .10 level.

^a The results shown in the Pr > Chisq column must be divided by two in order to yield the one-tailed test results.

Source: Author.

3. Significant Variables and Partial Effects

a. Base Case or Reference Individual

According to the Stay15 model results, there is an 88 percent probability that the base case Marine will stay to year 15. This reference individual is a white, Gunny (E7), without a Bachelor's or Master's Degree serving in a combat arms occupation. He is married with dependents.

b. Partial Effects

Table 17 shows the partial effects and significance levels for explanatory variables included in the Stay15 logit model and how they compare with the base case when any one variable is isolated and increased by one unit. According to the partial effects table, the probability of staying to 15 years is .073 lower for a single Marine with no dependents than for a married Marine with dependents. The probability of a Staff Sergeant staying to 15 years is .082 lower than for a Gunnery Sergeant, while the probability of an E8 staying to 15 years is .076 higher than for a Gunnery Sergeant. An E9's probability of staying to 15 years is .090 higher than for a Gunnery Sergeant.

Table 17. Partial Effects of Explanatory Variables on Retention to Year 15

Predicted retention probability for base case: .882

Partial Effect

n=909

Family Status:

married with dependents (base)

**Partial Effects of Explanatory Variables on
Retention to Year 15 cont.**

Predicted retention probability for base case:	.882
	<u>Partial Effect</u>
married no dependents	.029
single no dependents	-.073**
single with dependents	-.031
Race/Ethnic	
white (base)	
minority	.005
Education	
Other than Bachelor or Master's Degree (base)	
Bachelor or Master's Degree	-.003
Military Occupation	
Combat Arms (base)	
Combat Support	.017
Pay Grade	
Gunny (base)	
SSgt	-.083***
E8	.076***
E9	.090***

*** Significant at the .01 level when performing a one-tailed test.

** Significant at the .05 level when performing a one-tailed test.

* Significant at the .10 level when performing a one-tailed test.

Source: Author.

4. Restricted Model Tests

a. The family status variables and the pay grade variables were tested to determine if they were jointly significant for the model.

(1) The test for joint significance showed that the family status variables are not jointly significant in the model. Table 18 shows the output values associated with the joint significance test.

Table 18. Stay15 Model Joint Significance Test for Family Status

Wald Chi-Square	DF	Pr > ChiSq
5.1517	3	0.1610

Source: Author.

(2) The pay grade variables proved to be jointly significant at the .01 level. Table 19 shows the output values associated with the joint significance test.

Table 19. Stay15 Model Joint Significance Test for Pay_Grade

Wald Chi-Square	DF	Pr > ChiSq
31.2317	3	<.0001

Source: Author.

5. Potential Problems with the 15-Year Model

a. Omitted variable bias is a potential problem for the usefulness of the 15 Year Model. The inability to obtain valid data for geographical regions, unit types and prior service indicators made it impossible to test for differences associated with those key variables. It is important to note that many of the military retention literature studies do include these variables and often find them to be important influences on staying behavior.

b. Irrelevant variable bias could also potentially impact the validity of the 15-year model by unnecessarily inflating the standard errors of the other relevant variables. However, none of the nonsignificant variables were removed from this model, since they all had important theoretical justification for inclusion.

c. Multicollinearity was considered as a potential source of problems within the model. In a preliminary analysis it was determined that the degree of multicollinearity between average age, the family status variables, the education variable and the pay grade variables warranted the removal of age from the model. Once the age variable was removed, a variance inflation test was performed on the remaining variables. The results of the test, shown in Table 20, indicate that the problem of multicollinearity does not appear to be serious in the 15 Year Model.

Table 20. Test for Multicollinearity in the 15 Year Model

Variable	Estimate	Std. Error	Pr> t	VIF
Intercept	.88315	0.02551	<.0001	0
marriednodeps	.02369	0.03234	0.4640	1.04849
singlenodeps	-.07062	0.03430	0.0398	1.07514
Singledeps	-.02648	0.03277	0.4192	1.04225
Minority	.00696	0.03198	0.8278	1.00878
Bachelor MastersDeg	-.00177	0.02774	0.9491	1.02343
Combatspt	.01525	0.02224	0.4931	1.37167
SSgt	-.08002	0.02576	0.0020	1.37167
E8	.07311	0.02839	0.0102	1.38239
E9	.08330	0.03491	0.0172	1.26043

Source: Author.

B. RESULTS - 18 YEAR MODEL

1. Goodness of Fit

a. Global Null Hypotheses Test

The global null hypotheses test for the 18 year model, shown in Table 21, indicates that the model is significantly better, at the .01 level, than a model with just the intercept.

Table 21. Global Null Hypotheses Test for Stay18 Regression Model

Model Fit Statistics			
	Criterion	Intercept Only	Intercept and Covariates
	-2 Log L	913.049	786.852
Testing Global Null Hypothesis: BETA=0			
Test	Chi-Square	DF	Pr > ChiSq
Likelihood Ratio	126.1973	9	<.0001

Source: Author.

b. Hosmer-Lemeshow Test

Table 22 depicts the Hosmer-Lemeshow Goodness of Fit Test for the Stay18 Model. The Hosmer-Lemeshow Goodness of Fit Test indicates that the model fits the data as evidenced by a p-value of 0.8962.

Table 22. Hosmer-Lemeshow Goodness of Fit Test for Stay18 Regression Model

Chi-Square	DF	Pr > ChiSq
2.8768	7	.8962

Source: Author.

c. R-Square

Table 23 shows the R-square and Max-rescaled R-square values generated for the Stay18 model. The values of .1296 and .2045 for pseudo R-Squared and max R-squared, respectively, indicate that the 18 year model has a better linear fit than the 15 year model.

Table 23. R-Square and Max-rescaled R-Square for Stay18 Regression Model

R-Square	Max-rescaled R-Square
0.1296	0.2045

Source: Author.

d. Classification Table

Those reservists who stay to 18 years make up .7986 of the observations. The classification information in Table 24 indicates that at the .80 probability level, the model correctly predicted 65.7 percent of the stayers. Table 24 shows classification table results at the .50 and .80 probability levels.

Table 24. Classification Table for the Stay18 Model

Classification Table									
	Correct		Incorrect			Percentages			
Prob Level	Event	Non- Event	Event	Non- Event	Correct	Sensi- tivity	Speci- ficity	False Pos	False Neg
.500	725	2	181	1	80.0	99.90	1.1	20.0	33.3
.800	467	130	53	259	65.7	64.3	71.0	10.2	66.6

Source: Author.

2. Interpretation and Evaluation of Coefficients

a. Table 25 shows the parameter estimates for the Stay18 regression. The explanatory variables "SSgt", "E8" and "E9" are statistically significant at the .01 level for a one-tailed test. The variables "single no dependents", "Bachelor_MastersDeg", and "combatspt" are significant at the .10 level for a one-tailed test. Each of the statistically significant variables has the hypothesized sign shown in Table 11.

Table 25. Stay18 Logistic Regression Parameter Estimates for One-tailed Test

Parameter	Estimate	Std. Error	Chisq	Pr >Chisq ^a
Intercept	1.2317	.2115	33.9126	<.0001
marriednodeps	-0.1179	.2857	0.1702	0.6799
singlenodeps*	-0.4054	.2656	2.3290	0.1270
Singledeps	0.1424	.2910	0.2395	0.6246
Minority	0.00458	.2811	0.0003	0.9870
Bachelor MastersDeg	0.3034	.2526	1.4423	0.2298
combatspt*	0.2798	.1959	2.0402	0.1532
SSgt***	-0.9636	.1932	24.8655	<.0001
E8***	1.4642	.3369	18.8862	<.0001
E9***	2.2039	.6071	13.1787	<.0003

Model Fit Statistics		
Criterion	Intercept Only	Intercept and Covariates
-2 Log L	913.049	786.852
Likelihood Ratio		
Chi-Square	DF	Pr>ChiSq
126.1973	9	<.0001

*** Statistically Significant at the .01 level.

** Statistically Significant at the .05 level.

* Statistically Significant at the .10 level.

^a The results shown in the Pr > Chisq column must be divided by two in order to yield the one-tailed test results.

Source: Author.

3. Significant Variables and Partial Effects

a. Base Case or Reference Individual

Based on the Stay18 model results, there is a 77 percent probability that the base case Marine will stay to year 18. This reference individual is a white, Gunny (E7), without a Bachelor's or Master's Degree serving in a combat arms occupation. He is married with dependents.

b. Partial Effects

Table 26 shows the partial effects and significance levels for explanatory variables included in the Stay18 logit model and how they compare with the base case when any one variable is isolated and increased by one unit. According to the partial effects table, the probability of staying to 18 years is .079 lower for a single Marine with no dependents than for a married Marine with dependents. The probability of staying to 18 years is .045 higher for a Marine who works in a combat support

occupational field than for a Marine who works in a combat arms occupational field. Combat support, which is significant here, was not a significant factor in the 15 year model. The probability of a Staff Sergeant staying to 15 years is .207 lower than for a Gunnery Sergeant, while the probability of an E8 staying to 18 years is .163 higher than for a Gunnery Sergeant. An E9's probability of staying to 18 years is .195 higher than for a Gunnery Sergeant.

Table 26. Partial Effects of Explanatory Variables on Retention to Year 18

Predicted retention probability for base case:	.774
	<u>Partial Effect</u>
	n=909
Family Status:	
married with dependents (base)	
married no dependents	-.021
single no dependents	-.079*
single with dependents	.024
Race/Ethnic	
white (base)	
minority	.001
Education	
Other than Bachelor or Master's Degree (base)	
Bachelor or Master's Degree	.049
Military Occupation	
Combat Arms (base)	
Combat Support	.045*
Pay Grade	
Gunny (base)	
SSgt	-.207***

Table 26. Partial Effects of Explanatory Variables on Retention to Year 18 cont.

Predicted retention probability for base case: .774	
	<u>Partial Effect</u>
	n=909
E8	.163***
E9	.195***

*** Significant at the .01 level for a one-tailed test.

** Significant at the .05 level for a one-tailed test.

* Significant at the .10 level for a one-tailed test.

Source: Author.

4. Restricted Model Tests

a. The family status variables and the pay grade variables were tested to determine if they were jointly significant in the model.

(1) The family status variables proved to be jointly insignificant in the model. Table 27 shows the output values associated with the joint significance test.

Table 27. Stay18 Model Joint Significance Test for Family Status

Wald Chi-Square	DF	Pr > ChiSq
2.9515	3	.3992

Source: Author.

(2) The pay grade variables proved to be jointly significant at the .01 level. Table 28 shows the output values associated with the joint significance test.

Table 28. Stay18 Model Joint Significance Test for Pay_Grade

Wald Chi-Square	DF	Pr > ChiSq
83.8970	3	<.0001

Source: Author.

5. Potential Problems with the 18-Year Model

As was the case for the 15 year model, it should be noted that omitted variable bias could present a potential problem for the overall usefulness of the 18 Year Model and irrelevant variables could also be a source of inefficiency.

6. Multicollinearity

As for the 15 year model, once age was omitted from the model, the problem of multicollinearity does not appear to be serious in the 18 Year Model. Table 29 shows the variance inflation factors for the explanatory variables in the 18 year model.

Table 29. Test for Multicollinearity in the 18 Year Model

Variable	Estimate	Std. Error	Pr> t	VIF
Intercept	.77891	.03103	<.0001	0
marriednodeps	-.01502	.03937	.7028	1.04849
singlenodeps	-.06739	.04175	.1069	1.07514
Singledeps	.02094	.03989	.5998	1.04225
Minority	-.00136	.03892	.9722	1.00878
Bachelor MastersDeg	.04192	.03377	.2148	1.02343
Combatspt	.03842	.02708	.1562	1.06906
SSgt	-.19042	.03135	<.0001	1.37167
E8	.14562	.03455	<.0001	1.38239
E9	.16942	.04250	<.0001	1.26043

Source: Author.

V. CONCLUSIONS AND RECOMMENDATIONS

The findings of this study contribute to an understanding of the factors influencing continuation rates in the United States Marine Corps Selected Reserves. The models set forth in Chapter IV present the Marine Corps with a starting point for building useful retention forecasting tools for the career force.

This thesis examined two continuation models in order to analyze the probability that career Marines in the ranks of E6 - E9 would serve to at least 15 years of service and 18 years of service, respectively. The models included two categories of explanatory variables: demographic and military specific. Logistic regression was chosen as the most appropriate tool for analyzing the data due to the fact that the dependent variables were dichotomous.

A. CONCLUSIONS

1. Significant Factors for Retention to 15 and 18 Years

a. The demographic variables "single no dependents", and the military variables "SSgt", "E8", and "E9" proved to be significant factors in determining whether or not a Marine stays to at least 15 years of service in the Selected Reserves. Single Marines with no dependents are less likely to continue to serve for 15 years when compared to a married Marine with dependents. A Marine who has only attained the rank of Staff Sergeant is significantly less likely to reach this milestone than a Gunnery Sergeant (E7). Marines who have attained the top

ranks of E8 or E9 are significantly more likely to serve for 15 years when compared to those in pay grade E7, the base case.

b. Marines of higher rank are more likely to serve for a greater number of years. In most cases, this is a likely a result of time in service factors that influence eligibility for the next higher pay grade. Marines who have remained a lower rank after many years of service may be discouraged.

c. A single Marine has more flexibility to seek other employment opportunities and is not burdened with the responsibility of providing for dependents. Single Marines are also generally younger than married Marines and more apt to migrate to new civilian jobs.

d. The variables depicted as significant in the 15 year model were also depicted as significant variables in the 18 year model. However, the notable difference was found with the variable "combat support". The combat support variable, which was not significant in the 15 year model, was found to be significant in the 18 year model, indicating that Marines who are in combat support occupations, are more likely to complete 18 years of service than those in combat arms occupations. The former occupations are less physically demanding than the latter, and may be a better match for more senior Marines.

2. Factors That are Not Significant for Retention to 15 and 18 Years

a. Level of Education proved not to be a significant factor for explaining retention to 15 Years or to 18 years. Marines have been using government-funded tuition assistance to seek higher degrees in recent years, but attaining a college degree may have more impact on their civilian employment than on reserve participation.

b. Race was also not a significant factor in predicting continuation in either the 15-year or the 18-year model. It may have proved insignificant due to the small number of minority group members in the sample. In addition, once a Marine reaches the 15 or 18 year milestone, the vast majority, regardless of race or ethnic group, are likely to have found a good job match and be focusing on reaching the retirement milestone.

c. Occupation was not significant factor in predicting which Marines would serve to 15 years, but it did prove to be a significant factor in the 18 year model. This fact that the "occupation" variable is not significant in the 15 year model is probably more a reflection of the low number of leavers available for analysis in the 15 year model.

B. POLICY IMPLICATIONS

As the Marine Corps continues to serve as "America's Force in Readiness" in the battle against terrorism and future threats to the nation, it is imperative that we retain the highly trained and experienced Marines in the senior enlisted ranks. At this point in our history, the

Corps can ill afford to be caught off guard in the event the retention picture shifts to one that is more austere. The short-term and long-term outlook points to the fact that the Marine Corps will continually be called upon to execute a myriad of operations ranging from humanitarian assistance to full fledged war. In keeping with its long history of attacking an issue before it becomes a problem, utilization and improvement of the tools provided in this study could potentially prove useful in maintaining an optimal force and conserve the Marine Corps' resources in the future.

An incentive package in the form of a bonus could be used to reduce the significant number of Staff Sergeants who serve to year 15 but depart prior to 18 years. The decision on the part of the Staff Sergeants to leave the Selected Reserves after 15 years but prior to retirement eligibility deprives the Corps of the experience and knowledge gained up to the point of separation. In order to entice this pool of Staff Noncommissioned Officers to continue serving, an incentive package could be used to reward them for their years of service up to the 15-year milestone with a contractual agreement to serve at least an additional five years.

The decision to separate prior to 15 years or 18 years of service was also depicted as significant for single Marines with no dependents. Providing mentors to this population, especially if they relocate as a requirement for their civilian job, may serve as an incentive to locate a new unit as soon as possible. Once a unit has been identified by the relocating Marine, the presence of a

mentor, in a senior rank, may serve as an incentive to continue service at least through year twenty.

C. RECOMMENDATIONS FOR FURTHER STUDY

1. The results of this study could prove useful for maintaining retention levels in the Staff Noncommissioned Officer ranks, but much work has to be done in order to improve or test the practical validity of the models presented in this thesis. The following recommendations are presented as suggestions for improving upon the foundation laid by this study:

a. In order to explain actual behavior, retention survey results could be matched with the personnel data used in this study and analyzed. Survey results would allow for the inclusion of cognitive/perceptual variables in the models, as discussed in the literature review. The development and analysis of this new set of variables could potentially improve the predictive power of the models.

b. A key factor in completing a successful analysis lies in the data collection phase. Currently the data provided by DMDC, at best, is challenging to analyze. The problem stems from the fact that so much information is missing. Bringing the Marine Corps Total Forces Data Warehouse on line would provide future researchers another venue for obtaining complete data.

c. It is highly recommended that future researchers concentrate their efforts on obtaining personnel data that uses the new file layout adopted by

DMDC in 1994. The older files, as a result of missing information, present an obstacle.

d. The decision to remain in the Selected Reserves for at least 15 or 18 years is a complex choice. This research does not suggest that the decision can be explained by a rudimentary retention model, but it does try to lay the groundwork for exploring the factors that influence Marines to stay in the Selected Reserves past the end of their initial obligation to the country.

LIST OF REFERENCES

1. <http://mcrsc.mfr.usmc.mil/GuideBook/04Sec1.pdf>,
February 2004.
2. <http://www.defenselink.mil/execsec/adr1999/chap8.html>,
February 2004
3. Title 10, U.S. Code, Subtitle E, Part I, Chapter 1003,
Sec. 10102.
4. Title 10, U.S. Code, Subtitle E, Part I, Chapter 1005,
Sec. 10151.
5. MCO P1001r.1J (1999), *Marine Corps Reserve
Administrative Management Manual*. Quantico, VA.
6. DD Form 4/1, *Enlistment/Reenlistment Document Armed
Forces of the United States*, January 2001.
7. Price, J.L., *The Study of Turnover*. Ames, IA: Iowa
State University Press. 1977.
8. Zinner, M. A., *U.S. Marine Corps Company - Grade
Officer Retention*, M.S. thesis, Naval Postgraduate
School, Monterey, CA, March 1997.
9. Herzberg, F., Mausner, B., Peterson, R.O., and Capwell,
R., Job Attitudes: Review of Research and Opinions,
Pittsburgh Psychological Services, Pittsburgh, PA, 1957.
10. March, J.G. and Simon, H.A., *Organization*, Wiley, New
York, NY, 1958.
11. Porter, L., Steers, R., "Organizational, Work and
Personal Factors in Employee Turnover and
Absenteeism." Psychological Bulletin, 1973. Vol. 80.
No. 2, pp 151-176.
12. Mobley, W., "Intermediate Linkages in the Relationship
Between Job Satisfaction and Employee Turnover."
Journal of Applied Psychology, 1977. Vol. 62. No. 2,
pp 234-236.

13. Mobley, W., S. Horner, and A. Hollingsworth. "An Evaluation of Precursors of Hospital Employee Turnover Process," Journal of Applied Psychology, 1978, Vol. 63, No. 4, pp. 408-414.
14. Cotton J., and J. Tuttle. "Employee Turnover: A Meta-analysis and Review with Implications for Research," Academy of Management Review, 1986, Vol. 11, No. 1, pp. 55-70.
15. Ehrenberg, R., Smith, R., Modern Theory and Labor Public Policy Economics, Addison-Wesley, 7th Ed., 2000
16. May, Laurie J., The Effect of Personal Characteristics on Attrition From The Selected Marine Corps Reserve, Center For Naval Analyses, August 1987.
17. Fithian, D. An Analysis of Retention of First Term Enlisted Personnel in the Selected Reserve. Unpublished M.S. thesis. Monterey, CA: Naval Postgraduate School, 1988.
18. Marsh, R. M., (1989). Predicting Retention in the U. S. Navy: Officers and Enlisted, Journal of Political and Military Sociology, 17, pp. 1-26.
19. Kocher, K., Thomas, G., Naval Postgraduate School, Gender Differences in the Retention of Enlisted Army Reservists, November 1990.
20. Sheila Kirby, David Grissmer, A RAND NOTE, Reassessing Enlisted Reserve Attrition: A Total Force Perspective, 1993.
21. Zinner, M., U. S. Marine Corps Company - Grade Officer Retention. Unpublished M.S. thesis. Monterey, CA: Naval Postgraduate School, 1997.
22. Gjurich, G., A Predictive Model of Surface Warfare Officer Retention: Factors affecting Turnover. Unpublished M.S. thesis. Monterey, CA: Naval Postgraduate School, 1999.

23. Buttrey, S., Larson, H., Naval Postgraduate School. Determining Characteristic Groups to Predict Army Attrition.
24. O'Brien, W. E., The Effects of Marine Corps Enlisted Commissioning Programs on Officer Retention. Unpublished M.S. thesis, Monterey, CA: Naval Postgraduate School, 2002.
25. Rostker, B., and R. Shishko, "The Economics of Multiple Job Holding," *American Economic Review*, Volume 66, No. 3, June, 1976.
26. Grissmer, D., and S. Kirby. Attrition and Retention in the Army Reserve and Army National Guard: An Empirical Analysis. Santa Monica, CA: Rand Corporation, 1985.
27. Randall, J., Factors Influencing the Retention of Noncommissioned and Staff Noncommissioned Officers in the Selected Marine Corps Reserve. Unpublished M.S. thesis. Monterey, CA: Naval Postgraduate School, 1989.
28. Kirby, S., Grissmer, D., Williamson, S., Naftel, S. Costs and Benefits of Reserve Participation: New Evidence From the 1992 Reserve Components Survey. National Defense Research Institute, RAND. 1997.
29. Department of Defense Instruction 7730.54, Reserve Components Common Personnel Data System (RCCPDS), March 1999.
30. Wooldridge, J. (2003), *Introductory Econometrics.* 2d ed. South-Western.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
Ft. Belvoir, Virginia
2. Dudley Knox Library
Naval Postgraduate School
Monterey, California
3. Marine Corps Representative
Naval Postgraduate School
Monterey, California
4. Director, Training and Education, MCCDC, Code C46
Quantico, Virginia
5. Director, Marine Corps Research Center, MCCDC,
Code C40RC
Quantico, Virginia
6. Marine Forces Reserve (Operations Officer)
New Orleans, Louisiana
7. Lecturer Kathy Kocher
Naval Postgraduate School
Monerey, California
8. Professor Samuel Buttrey
Naval Postgraduate School
Monterey, California
9. Reginald L. Hairston
Quantico, Virginia